Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

Claim 1. (Currently Amended) A method for producing a silicon nitride filter, which comprises:

heat-treating, in an atmosphere containing substantially only nitrogen to one that contains no oxygen, a green body comprising:

from 35 to 90 wt % of silicon nitride particles having an average particle diameter of from 1 to 30μm,

from 5 to 60 wt % of a pore-forming agent of spherical organic polymer particles selected from the group consisting of a polyvinyl alcohol, an acrylic resin, a vinyl acetate resin or cellulose ranging in size from 20 to 100 μm and

from 0.1 to 5 wt % of metal oxide solid particles,

provided that the total amount of the silicon nitride particles, the pore-forming agent and the metal oxide particles is at least 90 wt %, to form a porous product that effectively filters particulate matter from diesel fuel.

Claim 2. (Original) The method for producing a silicon nitride filter according to Claim 1, wherein the metal oxide particles contain, as the main component, an oxide of at least one metal selected from the group consisting of Al, Ca, Sr, Ba, Y, Mg and Yb.

Claim 3. (Canceled)

Claim 4. (Original) The method for producing a silicon nitride filter according to Claim 1, wherein the porosity of the filter is from 30 to 80 %.

Claim 5. (Original) The method for producing a silicon nitride filter according to Claim 1, wherein the average pore diameter as measured by a mercury immersion method of the filter is from 5 to 20 μm.

Claim 6. (Original) The method for producing a silicon nitride filter according to Claim 1, wherein the heat-treating conditions are such that the green body is maintained in a nitrogen atmosphere at a temperature within a range of from 1,450 to 1,800° C for from 1 to 12 hours to carry out the heat treatment.

Claims 7-8. (Canceled)

Claim 9. (Currently Amended) A method for producing a silicon nitride filter, which comprises:

heat-treating, in an atmosphere containing substantially only nitrogen to one that contains no oxygen, a green body comprising:

from 45 to 85 wt % of silicon nitride particles having an average particle diameter of from 1 to 30μm,

from 10 to 50 wt % of metal oxide hollow particles and

from 0.1 to 5 wt % of metal oxide solid particles,

provided that the total amount of the silicon nitride particles, the metal oxide hollow particles and the metal oxide solid particles is at least 90 wt %, to form a porous product and having a porosity of 30 to 80 % and an average pore diameter as measured by a mercury immersion method of from 5 to 40 μm which effectively filters particulate matter from diesel

fuel.

Claim 10. (Original) The method for producing a silicon nitride filter according to Claim 9, wherein the metal oxide solid particles contain, as the main component, an oxide of at least one metal selected from the group consisting of Al, Ca, Sr, Ba, Y, Mg and Yb.

Claim 11. (Original) The method for producing a silicon nitride filter according to Claim 9, wherein the average particle diameter of the metal oxide hollow particles ~~is~~ ranges 30 to 200 μm.

Claim 12. (Original) The method for producing a silicon nitride filter according to Claim 9, wherein the metal oxide hollow particles contain, as the main component, an oxide of Al and/or Si.

Claim 13 and 14. (Canceled)

Claim 15. (Original) The method for producing a silicon nitride filter according to Claim 9, wherein the heat-treating conditions are such that the green body is maintained in a nitrogen atmosphere at a temperature within a range of from 1,600 to 1,800° C for from 1 to 12 hours to ~~carry out~~ perform the heat treatment.

Claim 16. (Canceled)

Claim 17. (Previously Presented) The method for producing a silicon nitride filter according to Claim 9, wherein the content of the organic polymer pore-forming agent ranges from 15 to 40 wt %.

Claim 18. (Canceled)

Claim 19. (Previously Presented) The method for producing a silicon nitride filter according to Claim 9, wherein the metal oxide hollow particles have a porosity of 40 to 80 %.

Claim 20. (New) A method for producing a silicon nitride filter, which comprises:

heat-treating, in an atmosphere consisting essentially of nitrogen, a green body comprising:

from 45 to 85 wt % of silicon nitride particles having an average particle diameter of from 1 to 30μm,

from 10 to 50 wt % of metal oxide hollow particles, and

from 0.1 to 5 wt % of metal oxide solid particles,

provided that the total amount of the silicon nitride particles, the metal oxide hollow particles and the metal oxide particles is at least 90 wt %, to form a porous product, and having a porosity of 30 to 80 % and an average pore diameter as measured by a mercury immersion method of from 5 to 40 μm which effectively filters particulate matter from diesel fuel.

REMARKS

Claims 3, , 7, 8, 13, 14, 16 and 18 have been canceled. Claims 1, 2, 4-6, 9-12, 15, 17 and 19 and new Claim 20 remain active in the case. Reconsideration is respectfully requested.

The present invention relates to a method of producing a sintered silicon nitride filter.

Specification Amendments

The specification has been amended in order to insert needed titles at appropriate sections of the text. The amendments are believed sufficient to satisfy the requirements of paragraph 1 of the Office Action.

Claim Amendments

Claim 1 has been amended by limiting its scope to spherical organic polymer particles that are selected from the group consisting of a polyvinyl alcohol, an acrylic resin, a vinyl acetate resin or cellulose as the pore-forming agent, which subject matter is found in Claim 16 which has now been canceled. Claim 9 has been amended by limiting the claims to the limitations of Claims 13 and 14. New Claim 20 is directed to the same subject matter of Claim 9 except that the atmosphere in which the green body is heat-treated is defined as consisting essentially of nitrogen. Further the specific pore forming agents of Claim 16 have been placed in Claim 1 and Claim 16 has been canceled. Entry of the amendments is respectfully requested.

Support for the requirement that the filter embodiments of the invention are useful for

the filtering of particulates from diesel fuel is found on page 28 of the text.

Claim Rejection, 35 USC 112, First Paragraph

As to the question of whether the identified language in Claim 1 is meant to define a range, it is believed clear that the language pertaining to the atmosphere of nitrogen gas, in fact, identifies a range of gas from a nitrogen atmosphere that contains no oxygen to one which contains only very little oxygen. The nitrogen atmosphere should not contain amounts of oxygen that would result in conversion of the silicon nitride to oxide material. Thus, the meaning of the phrase is believed clear. Applicants point out that new Claim 20 has been presented which identifies the condition of the atmosphere as consisting essentially of nitrogen. This language only permits the presence of oxygen in the atmosphere in quantities that do not adversely affect the green body being heat-treated. Entry of the new claim into the record is respectfully requested.

As to the matter of support for the phrase in question, applicants refer to page 12, first paragraph, where suitable such support is found. Here it is clearly indicated that the nitrogen atmosphere employed contains either no oxygen or substantially comprises nitrogen only. Accordingly, the specification clearly enables the skilled artisan to practice the invention as claimed.

Invention

As claimed in the embodiment of the invention as claimed in Claim 1, a sintered silicon nitride filter is produced by heat-treating, in a nitrogen atmosphere containing no

oxygen, a green body comprising from 35 to 90 wt % of silicon nitride particles having an average particle diameter of from 1 to 30μm, from 5 to 60 wt % of a pore-forming agent of spherical organic polymer particles selected from the group consisting of a polyvinyl alcohol, an acrylic resin, a vinyl acetate resin or cellulose ranging in size from 20 to 100 μm and from 0.1 to 5 wt % of metal oxide solid particles, provided that the total amount of the silicon nitride particles, the pore-forming agent and the metal oxide particles is at least 90 wt %, to form a porous product that is effectively useful as a filter for diesel fuel particulates.

Claim 19 is directed to the embodiment of the invention that is a method for producing a silicon nitride filter by heat-treating, in an atmosphere containing substantially only nitrogen to one that contains no oxygen, a green body that is constituted of from 45 to 85 wt % of silicon nitride particles having an average particle diameter of from 1 to 30μm, from 10 to 50 wt % of metal oxide hollow particles, and from 0.1 to 5 wt % of metal oxide solid particles, provided that the total amount of the silicon nitride particles, the metal oxide hollow particles and the metal oxide solid particles is at least 90 wt %, to form a porous product and having a porosity of 30 to 80 % and an average pore diameter as measured by a mercury immersion method of from 5 to 40 μm which effectively filters particulate matter from diesel fuel.

Prior Art Rejection

Claims 1, 4, 5, 7, 9-14 and 16-19 stand rejected under 35 U.S.C. § 103 as being obvious over Niwa et al in view of Apte et al '429. This ground of rejection is respectfully traversed.

The Niwa et al patent, as stated previously, discloses a porous ceramic product that possesses thermal shock resistance. The product is prepared by heating a raw material ceramic powder that is selected from a group of materials including silicon nitride. In the thermal process of forming the porous ceramic product, hollow oxide particulate material is used as the means of introducing porosity into the ceramic product obtained. The sintered product obtained is used as a valve unit that has high durability. The claims of the present invention, however, are clearly distinguished over the reference on the basis that the silicon nitride filter is directed to the specific aspect of being effective in the filtering of particulates from diesel fuel.

Applicants maintain that an important distinction between the present process as claimed in Claim 1 and the patent is that the pore-forming substance is spherical organic polymer particles of a size ranging from 20 to 100 μm, whereas the patent clearly teaches hollow metal oxide particles as the pore forming agent. The particles are disclosed as having a size in the range from 20 to 250 μm order to introduce the appropriate porosity into the product. On the other hand, the patent **does not** show a particulate, organic pore-forming material for the clear purpose of introducing pores into the ceramic product. In fact, the only disclosure of an organic material in the process of the patent is as a binder for the particulate mixture used as the starting material. As disclosed in column 7, lines 10-24, the organic material **must be** "burned off" or evaporated from the ceramic prior to any sintering of the ceramic. There is no pore forming function taught for the organic material. Moreover, as stated previously, there is a clear teaching in the patent which leads the skilled artisan away from the use of organic binder material in the preparation of the porous product of the patent

in the experiment described in columns 8 and 9. In the Comparative Examples 1 to 3, epoxy resin, acrylic resin and phenolic resin were used as binders said to be a replacement of the hollow metal oxide particles. The results in Table 1 in column 10 of the patent show that porous ceramic products of these three examples were obtained, all of which exhibited inferior thermal shock resistance, rate of ΔT and sliding durability properties in comparison to Examples 1 and 2 of the patent where ceramic products were prepared from compositions containing hollow particles. Accordingly, with respect to Claim 1 as now claimed, Niwa et al does not suggest the method of Claim 1 of the present case.

As to present Claim 9 as amended, the reference does not teach a silicon nitride filter that effectively filters particulates from diesel fuel whose porosity is from 30 to 80 wt % and whose average pore diameter ranges from 5 to 40 μm. Accordingly, the patent does not teach or suggest the method embodiments of the invention.

Although the Apte et al patent discloses a method of manufacturing a porous ceramic such as of silicon nitride in which an organic agent is used a pore forming agent, nevertheless the process employed involves the preparation of ceramic preforms on a tape in which a colloidal suspension of ceramic particles and other components are spread on a tape. The colloidal solution may contain a pyrolysable pore forming agent of which types are disclosed at column 7, lines 37-39. However, in the present process a mixed material is prepared which is subjected to extrusion molding or press molding followed by heat treatment which is not a process disclosed in Apte et al. This is of significance because as the present process as defined in the claims, the pore forming agent that is employed is one of several agent which are a polyvinyl alcohol, an acrylic resin, a vinyl acetate resin or cellulose. None of these

materials are described in Apte et al. Accordingly, one of skill in the art would not be led to employ the specific pore forming agents of the present invention in view of disclosures which do not teach these materials. Thus, the combined references are believed not to suggest the invention and withdrawal of the same is respectfully requested.

Claims 6 and 15 stand rejected under 35 U.S.C. § 103 as being obvious over Niwa et al in view of Apte et al '429 and further in view of Watanabe et al '917. This ground of rejection is respectfully traversed.

Claim 6 (Claim 15) is directed to a secondary aspect of the invention which more specifically defines the high temperature heat treatment of the present process. As such, the time and temperature conditions of pyrolyzing the green body in the present process are not aspects which are critical to the invention. Further, given that the aspect of Claim 6 is dependent upon a claim that is believed patentably distinguishable over the cited and applied prior art, withdrawal of the rejection is respectfully requested.

It is submitted that this application is now in condition for allowance. Early notice to this effect is earnestly solicited.

Respectfully submitted,

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